REMARKS

In response to the Office Action dated July 30, 2001, favorable reconsideration and allowance of the present patent application are respectfully requested in view of the foregoing amendments and following remarks. Claims 1-14 are pending in the application.

Figures 1, 2, and 4 were objected to because of the informalities identified on page 2 of the Office Action. The separately submitted Request for Approval of Drawing Changes addresses these objections by making the corrections suggested by the Examiner. Accordingly, the Applicants respectfully request the Examiner to reconsider and withdraw this objection.

The specification was objected to because of informalities. This Amendment addresses this objection by correcting the noted informalities in the specification as discussed with the Examiner in a phone interview on October 23, 2001. Accordingly, withdrawal of this objection is respectfully requested.

The claims were objected to because of informalities. This Amendment addresses this objection by correcting the noted informalities in the claims. Accordingly, withdrawal of this objection is respectfully requested.

Prior to discussing the grounds of rejection in detail, a brief summary of Applicants' claimed combinations are described below in order to highlight advantageous characteristics thereof.

The Applicants' invention relates to a moving picture encoding system that can control both picture quality and the amount of codes generated. In one embodiment this achieved by providing a moving picture encoding system for

encoding each picture included in a sequence of moving pictures in units of a unit group comprises of a plurality of pictures including each picture. The system comprising an encoding control means for, when said unit group includes a plurality of different types of pictures which are to be encoded with different encoding methods. The encoding control means sets a target quantizer step size used to encode each of the different types of pictures included in said unit group. The encoding control means also performs a control operation to generate and furnish a quantizer step size so that a ratio among the target quantizer step sizes set for the different picture types is a predetermined one. The control operation is determined in accordance with a feature of the sequence of moving pictures to be encoded which represents a degree of complexity of said sequence of moving pictures to be encoded. An encoding means is also provided for encoding said each picture included in said sequence of moving pictures including said each picture using said quantizer step size furnished by said encoding control means and using either said each picture or prediction from a past intra-coded image and/or a predictive coded picture.

Claims1-14 were rejected under 35 U.S.C. § 102(b) as allegedly being anticipated by Odaka et al. (U.S. Patent No. 5,317,397). Applicants respectfully traverse each of these rejections for at least the following reasons.

Regarding claim 1, contrary to the teachings of the present invention that can control both the picture quality and the amount of codes generated, the Odaka et al. reference teaches only to perform an allocation of the amount of codes in a predetermined constant manner. The Odaka et al. patent discloses a

system that has essentially the same features as described in the present specification on page 6, line 10 to page 8, line 17, and Fig. 5. The Odaka et al. patent explicitly refers to three steps (col. 22, lines 51-57) that are performed for rate control as:

> (1) allocating an amount of bits (a bit rate) to N pictures from the I picture to the B3 picture immediately before the next I picture;
>
> (2) allocating and updating an amount of bits for each picture; and
>
> (3) controlling the quantization step size in each picture by using a virtual buffer.

Therefore, the Odaka et al. patent and other prior art systems discussed can at best simply prevent an extreme variation of the picture quality. They achieve this by updating the allocation rate of the amount of codes in such a manner so as to set the relationship among the I, P and B pictures to a predetermined constant relationship. These systems allocate the amount of codes based only on the global complexity measures (i.e., Xi, Xp and Xb). The primary function of the encoding control processes of the prior art systems is to allocate the target amount of codes to each of the three picture types based on the global complexity measure that is a product of the number of generated bits and the respective quantizer step size.

Unlike the prior art systems, the encoding control process defined in claim 1 is not totally dependent on the allocation of a target amount of codes based on the global complexity measure for each picture, but is controlled in accordance with features of the sequence of moving

pictures. As outlined above, the purpose of the present invention is to provide an encoding system that can control both picture quality and the amount of codes generated. To achieve this, the quantizer step size is first set to each of a plurality of picture types (e.g., I, P, B). It is controlled thereafter so that a ratio among the target quantizer step sizes is set to a predetermined ratio in accordance with features of the sequence of moving pictures to be encoded. Thus, the amount of codes generated during the encoding operation of each of the plurality of pictures in a group of pictures (GOP) can be controlled, while maintaing the relative picture quality among the plurality of adjacent pictures in terms of time.

As stated in MPEP § 2131, "A claim is anticipated only if each and every element as set forth in the claim is found, either expressly or inherently described, in a single prior art reference." *Verdegaal Bros. v. Union Oil Co. of California*, 2 USPQ2d 1051, 1053 (Fed. Cir. 1987). Therefore, the Odaka et al. patent does not anticipate the Applicants' claimed combinations, at least because it does not teach that the encoding control operation is determined in accordance with a feature of said sequence of moving pictures to be encoded which represents a degree of complexity of said sequence of moving pictures to be encoded, as described above.

Further, Applicants submit that one of ordinary skill in the art would not have been motivated to modify the system of Odaka et al. to arrive at Applicants'

claimed combinations absent impermissible hindsight reference to Applicants' specification.

For at least the foregoing reasons, it is respectfully submitted that claim 1 is distinguishable over the applied art. The remaining dependent claims are allowable at least by virtue of their dependency on the above-identified independent claim. See MPEP § 2143.01. Moreover, these claims recite additional subject matter, which is not suggested by the documents taken either alone or in combination.

For example, in addition to the reasons provided for claim 1 the features of claim 2 further define over the cited documents. Regarding claim 2, the Examiner has alleged that the Odaka et al. patent discloses "that the activity or complexity, i.e. spatial and temporal differences, is detected before setting the proper quantization step size for that frame type" (Office Action, page 2) and cites specific passages of the Odaka et al. patent. However, even if this were a proper interpretation of the teachings of the Odaka et al. patent, it does not address the claimed features in the Applicants' claimed combinations. Specifically, the Odaka et al. patent does not teach to update the quantizer step size so that the average of the quantizer step sizes used during the encoding of all macroblocks in said each picture finally approaches the target quantizer step size set for the picture type of said each picture currently being encoded. Thus, in contrast to the Odaka et al. patent, the present invention can control both the picture quality and the amount of generated codes by independently controlling the quantizer step size directly related to the picture quality.

In contrast to the present invention, the Odaka et al. patent discloses a system that has essentially the same features as described in the present specification as discussed above.

As noted in step three ((3) controlling the quantization step size in each picture by using a virtual buffer) provided above, the quantization step size in each picture is controlled by using the virtual buffer. This approach is discussed in the Background section of the current specification (page 3, line 29 to page 5, line 8) and does not allow for independent control of the quanitzer step size as in the Applicants' claimed combinations.

As previously noted, MPEP § 2131 states, "A claim is anticipated only if each and every element as set forth in the claim is found, either expressly or inherently described, in a single prior art reference." *Verdegaal Bros. v. Union Oil Co. of California*, 2 USPQ2d 1051, 1053 (Fed. Cir. 1987). Therefore, the Odaka et al. patent does not anticipate the Applicants' claimed combinations, at least because it does not teach to update the quantizer step size so that the average of the quantizer step sizes used during the encoding of all macroblocks in said each picture finally approaches the target quantizer step size set for the picture type of said each picture currently being encoded, as described above.

For at least the foregoing reasons, it is respectfully submitted that claim 2 is distinguishable over the applied art.

All of the rejections and objections being addressed in the foregoing Remarks and Amendments, it is respectfully submitted that the application is now

in condition for allowance and a Notice of Allowance is courteously solicited. If the Examiner has any remaining questions concerning this application, he or she is invited to contact Mark E. Olds (Reg. No. 46,507), at (703) 205-8000 in the Washington, D.C. area.

If necessary, the Commissioner is hereby authorized in this, concurrent, and future replies, to charge payment or credit any overpayment to Deposit Account No. 02-2448 for any additional fees required under 37 C.F.R. § 1.16 or under 37 C.F.R. § 1.17; particularly, extension of time fees.

Respectfully submitted,

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MARKED-UP VERSION OF AMENDED CLAIMS

Claims 1-14 have been amended as follows.

1. (Amended) A moving picture encoding system for encoding each picture included in a sequence of moving pictures in units of a unit group comprised of a plurality of pictures including said each picture, said system comprising:

encoding control means for, when said unit group includes a plurality of different types of pictures which are to be encoded with different encoding methods, setting a target [quantiser] quantizer step size used to encode each of the different types of pictures included in said unit group, and for performing a control operation to generate and furnish a [quantiser] quantizer step size so that a ratio among the target [quantiser] quantizer step sizes set for the different picture types is a predetermined one, wherein said control operation is determined in accordance with a feature of said sequence of moving pictures to be encoded which represents a degree of complexity of said sequence of moving pictures to be encoded; and

encoding means for encoding said each picture included in said sequence of moving pictures including said each picture using said [quantiser] quantizer step size furnished by said encoding control means and using either said each picture or prediction from a past [intra coded] intra-coded image and/or a predictive coded picture.

2. (Amended) The moving picture encoding system according to claim 1, wherein said encoding control means initially sets the [quantiser]

quantizer step size for a macroblock to be encoded first in said each picture currently being encoded to the target [quantiser] quantizer step size set for the picture type of said each picture currently being encoded, and then, each time it encodes each of macroblocks remaining in said each picture currently being encoded, updates the [quantiser] quantizer step size initially set for the first macroblock so that the average of the [quantiser] quantizer step sizes used during the encoding of all macroblocks in said each picture finally approaches the target quantizer step size set for the picture type of said each picture currently being encoded.

3. (Amended) The moving picture encoding system according to Claim 1, wherein said encoding control means further extracts the [a] feature of said sequence of moving pictures to be encoded which represents a degree of complexity of said sequence of moving pictures to be encoded, and wherein said encoding control means adaptively updates said ratio among the target [quantiser] quantizer step sizes set for the different types of pictures according to said extracted feature of said sequence of moving pictures.

4. (Amended) The moving picture encoding system according to Claim 2, wherein said encoding control means further extracts the [a] feature of said sequence of moving pictures to be encoded which represents a degree of complexity of said sequence of moving pictures to be encoded, and wherein said encoding control means adaptively updates said ratio among the target

[quantiser] quantizer step sizes set for the different types of pictures according to said extracted feature of said sequence of moving pictures.

5. (Amended) The moving picture encoding system according to Claim 1, wherein said encoding control means determines whether an amount of codes to be generated when encoding said each picture in the unit group will deviate by a predetermined range or even more from a target amount of generated codes for said each picture if the encoding is carried out using the target [quantiser] quantizer step sizes set for the plurality of picture types, and wherein, if said encoding control means determines that such a deviation from the target amount of generated codes will occur, said encoding control means updates the target [quantiser] quantizer step sizes set for the different types of pictures.

6. (Amended) The moving picture encoding system according to Claim 2, wherein said encoding control means determines whether an amount of codes to be generated when encoding said each picture in the unit group will deviate by a predetermined range or even more from a target amount of generated codes for said each picture if the encoding is carried out using the target [quantiser] quantizer step sizes set for the plurality of picture types, and wherein, if said encoding control means determines that 'such a deviation from the target amount of generated codes will occur, said encoding control means updates the target [quantiser] quantizer step sizes set for the different types of pictures.

7. (Amended) The moving picture encoding system according to Claim 1, wherein said encoding control means further extracts the [a] feature of said sequence of moving pictures to be encoded which represents a degree of complexity of said sequence of moving pictures to be encoded, and determines whether a scene change has occurred during the encoding of said each picture included in said unit group, and wherein, if said encoding control means determines that a scene change has occurred during the encoding of said each picture, it updates said ratio among the target [quantiser] quantizer step sizes set for the different types of pictures and their values according to the extracted feature of said sequence of moving pictures.

8. (Amended) The moving picture encoding system according to Claim 2, wherein said encoding control means further extracts the [a] feature of said sequence of moving pictures to be encoded which represents a degree of complexity of said sequence of moving pictures to be encoded, and determines whether a scene change has occurred during the encoding of said each picture included in said unit group, and wherein, if said encoding control means determines that a scene change has occurred during the encoding of said each picture, it updates said ratio among the target [quantiser] quantizer step sizes set for the different types of pictures and their values according to the extracted feature of said sequence of moving pictures.

9. (Amended) The moving picture encoding system according to Claim 1, wherein said encoding control means determines whether a scene change has occurred during the encoding of said each picture included in said unit group, and wherein, if said encoding control means determines that a scene change has occurred during the encoding of said each picture, it adaptively changes the type of the current picture currently being encoded in which the scene change occurs and also updates said ratio among the target [quantiser] quantizer step sizes for the different types of pictures and their values.

10. (Amended) The moving picture encoding system according to Claim 2, wherein said encoding control means determines whether a scene change has occurred during the encoding of said each picture included in said unit group, and wherein, if said encoding control means determines that a scene change has occurred during the encoding of said each picture, it adaptively changes the type of the current picture currently being encoded in which the scene change occurs and also updates said ratio among the target [quantiser] quantizer step sizes for the different types of pictures and their values.

11. (Amended) A moving picture encoding system according to Claim 1, wherein said encoding control means only uses an amount of-generated-codes-versus-quantizer-step-size characteristic of pictures of a certain type in order to set the target [quantiser] quantizer step sizes used to encode the different types of pictures which are to be encoded with the different encoding methods.

12. (Amended) The moving picture encoding system according to Claim 2, wherein said encoding control means only uses an amount-of-generated-codes-versus-quantizer-step-size characteristic of pictures of a certain type in order to set the target [quantiser] quantizer step sizes used to encode the different types of pictures which are to be encoded with the different encoding methods.

13. (Amended) The moving picture encoding system according to Claim 1, wherein when said unit group includes a picture to be intra-coded or an I-picture, a picture to be predictive-coded or a P-picture, and a picture to be bidirectionally –predictive-coded or a B-picture, said encoding control means extracts the feature of said sequence of moving pictures which represents a degree of complexity of said sequence of moving pictures to be encoded, and wherein if the extracted feature of said sequence of moving pictures indicates that the amount of motion between pictures is relatively small, said encoding control means sets the amounts of generated codes assigned to each I-picture, each P-picture, and each B-picture within said unit group so that the amount of generated codes assigned to each I-picture is the largest, the amount of generated codes assigned to each P-picture is the second-largest, and the amount of generated codes assigned to each B-picture is the smallest, and, as the amount of motion between pictures represented by the extracted feature increases, updates said ratio among the target [quantiser] quantizer step sizes

for the different types of pictures so that the differences among the amount of generated codes assigned to each I-picture, each P-picture, and each B-picture are reduced.

14. (Amended) The moving picture encoding system according to Claim 2, wherein when said unit group includes a picture to be intra-coded or an I-picture, a picture to be predictive-coded or a P-picture, and a picture to be bidirectionally- predictive-coded or a B-picture, said encoding control means extracts the [a] feature of said sequence of moving pictures which represents a degree of complexity of said sequence of moving pictures to be encoded, and wherein if the extracted feature of said sequence of moving pictures indicates that the amount of motion between pictures is relatively small, said encoding control means sets target amounts of generated codes allocated to each I-picture, each P-picture, and each B-picture in said unit group so that the target amount of generated codes allocated to each I-picture, is the largest, the target amount of generated codes allocated to each P-picture is the second-largest, and the target amount of generated codes allocated to each B-picture is the smallest, and, as the mount of motion between pictures represented by the extracted feature increases, updates said ratio among the target [quantiser] quantizer step sizes for the different types of pictures so that the differences among the target amounts of generated codes allocated to each I-picture, each P-picture, and each B-picture are reduced.

A new Abstract has been added.